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Soil Conservation

U.S. Department of Agriculture

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From the Administrator

The "Best" Conservation Plan

Sometimes more experienced SCS hands can profit from the fresh, uncluttered viewpoint of a new employee. A case in point is the following report from Mary Kay Dix, a summer aid at the Allentown, Pennsylvania, field office:

"The first morning," wrote Mary Kay, "I went along to gather information for the development of a conservation plan. By way of questions asked and explanations given, I learned the importance of the cooperator's satisfaction with the plan.

"He must supply information on his problems and what he wants to do with his property. If he isn't happy with particular alternatives, then others must be found. It is important that the plan meets the needs of the cooperator, as well as solve a particular problem."

Conservation districts and SCS are concerned over why more conservation plans are not implemented. Mary Kay recognized one major reason when she said that the plan has to meet the needs of the cooperator; it has to satisfy him.

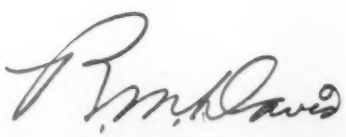
There may be several temporary reasons why a cooperator doesn't turn his plan into visible conservation—lack of funds or equipment, ill health or injury, unsuitable weather. But a more permanent reason for resistance may be that the farmer or rancher doesn't feel his plan really gives him acceptable alternatives.

No plan can be thrust upon a farmer or rancher—it's his plan! The good plan is the one developed with maximum input by the landowner. A soil conservationist can present facts, offer ideas and alternatives, answer questions, and even make suggestions. But he cannot intrude upon the responsibility of the land user to decide for himself which course he will follow.

To transform a plan into visible conservation, a landowner must make commitments of time, money, and materials. He may have to make extensive changes in the physical layout of his place to accommodate new conservation systems—move fences, tear out hedgerows, alter road systems. He may want to try a new system on a few acres before he commits himself to installing it on a quarter section. He may need to change cropping patterns or livestock operations—and these shifts are not often made easily.

We all need to keep Mary Kay's first-day lesson in mind. We need to listen to what the farmer or rancher has to say about his own particular situation. The best plan will be a compromise between what the conservationist may think is best from a technical standpoint and what the landowner feels comfortable with or wants to do. The workable plan blends "ideal" conservation with the realities of food and fiber production in a way that meets SCS technical standards and the landowner's conservation objectives.

The best conservation plan is the one that is put into action and that meets the needs of the landowner and his family as well as protecting the natural resources they manage for all of us.



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John A. Knebel
Secretary of Agriculture

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Soil Conservation Service

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Cover:
The pristine Washougal River in southwestern Washington is a tributary of the Columbia. With national goals of clean water, SCS is becoming more involved in water quality (see story on page 12).

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When a Pipeline Is Proposed

by Roger A. Hansen

Billed as one of the largest privately financed projects in the world—at $8.5 billion—a proposed natural gasline from Alaska's North Slope to the lower 48 states has been the subject of an environmental impact statement that required 2 years to prepare. SCS looked particularly at the possible impacts on agricultural lands.

What would be the impact on the environment if a pipeline for natural gas were built from Alaska's North Slope to the lower 48 states?

That was the question tackled by a federal interagency task force which published its findings in an 11-volume environmental impact statement earlier this year.

The route studied is one of two proposed to deliver natural gas 5,557 miles from Alaska's Prudhoe Bay, which has an estimated 22 to 26 trillion cubic feet of recoverable natural gas reserves, to three points in the United States: Antioch, California; Rye Valley, Oregon; and Delmont, Pennsylvania.

Six major companies have proposed the project: Alaskan Arctic Gas Pipeline Company; Canadian Arctic Pipeline Company, Limited; Northern Border Pipeline Company; Pacific Gas Transmission Company; Pacific Gas and Electric Company; and Interstate Transmission Associates (Arctic).

The high-pressure underground pipeline would measure 42 inches at its start and gradually decrease to 24 inches as gas is delivered for home and industrial uses.

The proposed route crosses approximately 1,900 miles of forest, 1,500 miles of cropland, 1,200 miles of grassland, 800 miles of tundra, and

The proposed natural gas pipeline would run from Alaska to three points in the United States. Its construction would be similar to that of the oil pipeline now underway.

100 miles of desert and chaparral.

Most of this land is privately owned. Of the 3,122 miles proposed through the United States, only 406 miles are on federal land.

The environmental impact statement was prepared by the Alaska Natural Gas Transportation System Project Environmental Impact Statement Task Force, U.S. Department of the Interior (USDI).

Task force members included representatives from nine agencies: Soil Conservation Service and Forest Service (USDA); Geological Survey, Fish and Wildlife Service, National Park Service, and the Bureaus of Land Management, Reclamation, Outdoor Recreation, and Mines (USDI).

The study results will influence the pipeline route and assist in identifying measures to lessen harmful effects on the environment. The proposed time schedule requires a project recommendation by the Federal Power Commission to the President by spring, and the President to make a decision by the latter half of 1977.

Severity of the long-term impact of pipeline construction also depends on whether the topsoil is preserved.

SCS's role on the task force included furnishing technical information and identifying impacts to soils, vegetation, land use, and ecological factors along the route. Ellis F. Sedgley, SCS state resource conservationist in Denver, Colorado, coordinated SCS efforts and served on the task force.

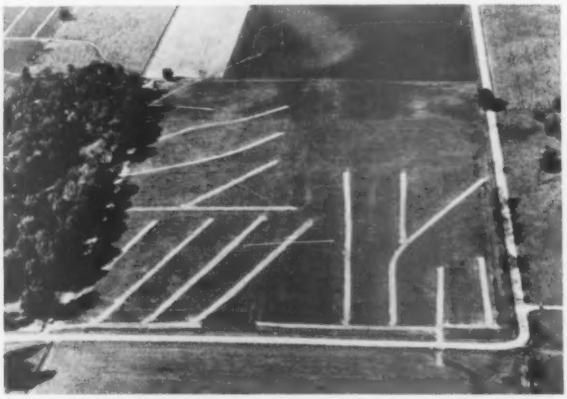
Some 70 employees from all levels of SCS furnished resource data and interpretations and identified potential environmental impacts. The task force also used soil surveys, state soil association maps, range site descriptions, and the SCS publication "Land Resource Regions and Major Land Resource Areas of the United States," which describes the environmental setting of the U.S. portion of the proposed project.

The coordination of soils information for the proposed route through Canada was done by John E. McClelland and Kenneth T. Ackerson of the SCS soil survey staff in Washington, D.C.

Of special interest is the potential impact on crops, farm drainage systems, and soils.

For instance, during construction of the pipeline, $3 million worth of crops along a 1,600-mile Montana-Pennsylvania route could be destroyed. Estimated losses on the 14,500 acres of cropland during construction are 472,000 bushels of corn, 80,000 bushels of soybeans, 88,000 bushels of small grains, and 5,300 tons of hay.

Disruption of farm drainage systems from North Dakota to Pennsylvania also was studied. Tile drainage systems in the Midwest are typically



Farm drainage systems would be particularly susceptible to disruption from the proposed pipeline project. Tile drainage systems in the Midwest, such as this newly installed one on an Ohio farm, are typically 3 to 4½ feet deep. To maintain gravity flow through the tile line, the pipeline trench would need to be 10 feet deep rather than the more common 7 feet.

The high-pressure pipeline would measure 42 inches at its start in Alaska and gradually decrease to 24 inches as gas is delivered for home and industrial uses.

3 to 4½ feet deep. For gravity flow through the tile line to be maintained, the pipeline trench would need to be 10 feet deep rather than the more common 7 feet.

Heavy construction equipment could crush shallow tile lines, which would then have to be replaced so wet spots would not develop and cause lowered crop production and poor farming conditions.

Severity of the long-term impact of pipeline construction also depends on whether the topsoil is preserved. The applicants for the route have stated that topsoil would be stockpiled and returned to the surface of the trench only in certain areas where stipulated by the landowners.

It would be the responsibility of the individual landowner, when negotiating with the pipeline company on the right-of-way easement, to determine what mitigating measures should be applied on his property.

Stockpiling requires two passes by a trenching machine—the first to dig the topsoil and pile it to the side; the second to dig through the subsoil.

The adverse effects associated with the pipeline construction will be carefully weighed against the nation's need for energy independence.

Single trenching mixes topsoil with generally adverse subsoils and prevents full restoration of the production potential of the land. The reestablishment and growth of plants under these circumstances can be extremely slow.

Other agricultural impacts of the proposed pipeline include:

—accelerated wind and water erosion on the exposed 84,000-acre right-of-way.

—increased downstream sedimentation.

—reduction of the esthetic quality of the landscape by removal or disruption of existing plant communities. In the case of forest land the companies propose preventing tree regrowth, because it would interfere with the operation and maintenance of the pipeline.

—potential disruption of irrigation water delivery systems where the proposed pipeline crosses irrigation canals in Idaho, Montana, and North Dakota.

—the disposal of excess rock and soil displaced by the pipe.

The adverse effects associated with the pipeline construction will be carefully weighed against the nation's need for energy independence. This study will help insure that all beneficial and adverse effects are known before the decision to construct the pipeline is made.

Mr. Hansen is an SCS resource conservationist, plant sciences staff, Denver, Colorado.

Severity of the long-term impact of pipeline construction depends on whether the topsoil is preserved. If it is mixed with subsoils, revegetation could be extremely slow.

Another impact of construction is the disposal of displaced rock and soil. As with the oil pipeline, vibrating compactors would be used to pack fill material around the line.

Putting a Village on the Map

by Jeffrey Loser

A "new" village opened this Bicentennial year near the Pennsylvania Turnpike. Its mission: to revitalize the economy and heritage of Bedford County. Behind the scenes, the community worked to provide research, furnishings, and financing for the colonial village.

With the opening of Bedford Historic Village in south-central Pennsylvania on July 4, 1976, local residents achieved a threefold purpose to boost colonial history, native crafts, and employment.

In its first season, the village attracted more than 20,000 visitors, staged numerous craft demonstrations, and provided jobs in a county where the unemployment rate has been 15 to 20 percent.

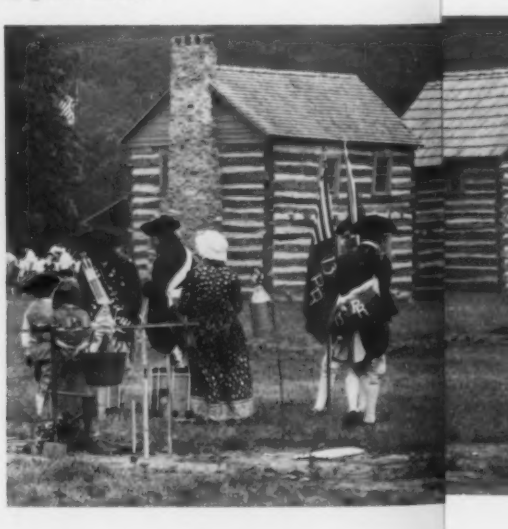
It has been a community project from the beginning. Local historians did the research, local groups and individuals provided information and artifacts, the County Redevelopment Authority bought the land, and residents raised $35,000 to help fund it.

Additional financial support has come from the Bedford County commissioners, the Pennsylvania Department of Commerce, the U.S. Department of Commerce's Economic Development Administration, and the Federal Comprehensive Employment Training Act (CETA).

More than 60 unemployed persons were hired through federal programs. They moved 12 historic buildings in the county to the village, including a barn and two schoolhouses. Projected employment for the 72-acre village when completed is 200 persons.

The Soil Conservation Service,

With many donations from the community, Bedford Village opened July 4 with a long-rifle salute.



through the Bedford County Conservation District, provided vegetative and soils information for the site. The village is a cooperator with the district.

In addition, SCS provided technical assistance to engineering students, hired through CETA, who laid out the pond and watercourses in the village.

As winter comes, workers will switch from outdoor to inside work. Plans for the village include a grist mill, log church, outdoor theater, 20 more houses, and eventually, an operating farm.

There is seemingly no end to the history the village can unfold. Within the county—which once covered most of western Pennsylvania— is Fort Bedford, one of the farthest forts west at one time; Forbes Trail, an old Indian route used by settlers and armies; and many 18th and 19th century homes and churches to research. One local historian has written eight volumes on the area.

For Bedford, the opening of the village marks also the beginning of revitalization of the county's economy and heritage.

Mr. Loser is SCS district conservationist, Bedford, Pennsylvania.

Lessons on Location

by Thomas W. Badger

There are a number of lessons to be learned at an historic and scenic site in the southeast corner of Kansas, and teachers, administrators, and students are out to incorporate them into their new outdoor learning center.

Fort Baxter . . . Quantrill's raid . . . the first cow town in Kansas.

All were once on the site of a new high school in southeastern Kansas, and faculty and students are taking full advantage of the location.

They've established an outdoor learning center on the year-old, 40-acre campus of the Baxter Springs Unified School District. And, as its program grows, the center will help bring the area's heritage to life with history and sociology lessons that are taught "on the spot."

The new center already is being used for photography, radio and television production, geology, and other subjects. Center study areas include a geology wall, upland and riparian woodlands, cropland, a river, and an oak forest.

Walkways soon will be built to the river for studies on water quality, and native vegetation for wildlife food and cover will be planted on the campus to round out the natural resource study areas.

Officials enlisted help to develop an outdoor learning center early in the school's planning. Their conservation plan was developed with assistance from the Cherokee County Conservation District, which now sponsors workshops to acquaint teachers with the learning center's potential.

The center also received assistance from the See-Kan Resource Conservation and Development (RC&D) Council. One RC&D measure resulted in a natural resource inventory by the Extension Service and the Soil Conservation Service.

The inventory identified trees, grasses, and other resources unique to the area, including 25 plant species found nowhere else in the state.

Another RC&D measure is stabilization of eroding areas at the center, including revegetation and improved drainage on steep slopes.

The center, near the Missouri Ozarks, isn't only for the benefit of the district's 900 elementary and high school students.

An adjoining school district has been invited to use the area . . . plans are underway for recreational facilities for the public . . . and a special invitation is going out to senior citizens to enjoy the outdoors at this historic and scenic learning center.

Mr. Badger, SCS district conservationist, Holton, Kansas, was formerly SCS district conservationist, Columbus, Kansas.

Keep on Trackin'

by Doris Laber

Bogged down with a wet track, students and teachers at a Maine high school picked up shovels—and knowledge—as they put in a tile line with the help of a soil and water conservation district, school officials, and an RC&D council.

Away.
Away.
Away.
That's how the track and field schedule for Medomak Valley High School in Waldoboro, Maine, has read every spring since the school opened in 1968. All meets have been held away.

"It's been an unbearable situation," Athletic Coach Arthur Dyer declared. "During most springs it has been so wet that a person walking on the track would leave footprints 2 to 4 inches deep.

The 100 boys and girls on teams had to compete—and even practice—on opponents' fields or neutral grounds. The entire student body was limited to indoor physical education classes each spring.

A remedy was found through student and teacher involvement in a special project of the Time and Tide Resource Conservation and Development (RC&D) area.

School officials found that the field drainage problem met the requirements for an RC&D measure. This could provide funds for the engineering design and materials.

The local sponsors—the Knox-Lincoln Soil and Water Conservation District (SWCD) and the school administrative district—would have to pay for labor and equipment, estimated at $4,000.

That left the project on the verge of bogging down as thoroughly as anyone who dared to venture out on the track.

Then Medomak students decided to pitch in and work for what they wanted. Their labors—in a learning situation—became the answer to the budget problems.

Under a detailed plan, 40 forestry and conservation students were released from classes for a week to prepare the area for backhoe work. Their teacher, Douglas Meservey, led the project. Meservey, a supervisor of the Knox-Lincoln SWCD, spent a week onsite with the students. He also was on call for assistance needed by other teachers supervising the job.

The athletic director and coaches were freed from regular duties to assist when needed. Other classroom teachers supplemented the team.

SWCD technician Raynold Holmes served as project director to see that the drainage system was installed according to specifications. He was "the thread of continuity for the program," said Meservey.

After lessons from Holmes in using a level, the students set grade stakes for the backhoe operator to follow.

Because of earlier work by students, they had use of a backhoe and operator at no charge. Students in building trades classes had built a storage shed for the town, so the town loaned them the equipment—the only heavy equipment used in the project besides gravel trucks.

After the trench was dug with the backhoe, students shaped the trench bottom to a grade of 1½ inches per 100 feet. They wielded shovels, spades, and wheelbarrows and carefully put gravel under and over 3,400 feet of tile.

"The students were very conscientious," Meservey said. "Some areas were done and redone to get the job right."

The work was completed in the "dry" season. Even then, students figured that the completed system was draining off water at the rate of

Students got lessons in surveying and laying tile with help from SWCD technician Raynold Holmes (above).

5 gallons every 4 minutes—enough to fill more than five railroad tank cars in a month.

The track is now resurfaced with finely crushed stone and the disturbed areas have been reseeded.

Improvements are not limited to the track. The school plans to set up sites for javelin, shotput, high jump, and broad jump in the infield and in nearby areas outside the track. Also, some of the soil displaced by the tile line has been used to fill potholes in the soccer and baseball fields.

Not the least of the improvements is that considerably less mud should be tracked into the school. "And that makes for good relations between maintenance and administrative people," said Dyer with a grin.

Come spring, the teams expect to play a full schedule, with 4 weeks added to their spring sports season.

And, at last, the programs will be listing games at "Home."

Ms. Laber is SCS public information officer, Orono, Maine.

Keep It Clean

by William Branigan

In Pennsylvania, a dairy farmer and conservation district chairman has devised a ramp to allow his cows to drink from a stream . . . yet keep it clean.

The dairy cows of John Vanderstappen take a well-thought-out step before they drink water from his stream.

Vanderstappen did the thinking . . . and building.

He designed and built a ramp to the stream that allows the cows to drink but not pollute the water. An electric fence and curb prevent them from entering the stream. The ramp is just wide enough for two cows to drink at a time but not to turn around and contaminate the water. They have to back out.

Vanderstappen designed the ramp, made of railroad ties, several years ago. He built one in each of his four pastures.

"Clean water is the most valuable resource I have for milk production," explains Vanderstappen, newly elected chairman of the board of directors of the Crawford Conservation District in northwestern Pennsylvania.

A native of Holland, where he first became conscious of water quality problems, Vanderstappen came to the United States in the 1950's, worked at a nursery, and then began farming. He has been a cooperator with conservation districts in Pennsylvania since 1964.

His emphasis on the quality of natural resources extends far beyond designing his ramp. He has made many improvements on his farm based on a knowledge of his soils. He maintains production—and conservation—through a crop rotation system of corn, oats, and hay; a four-pasture rotation system; and a tile drainage system. He has dug open drains to improve pasture and cropland and put in grassed waterways to control erosion.

He didn't learn all this the easy way, but he's a man who will have a washout only once.

One of those "learning experiences" came shortly after Vanderstappen bought his present farm. It had a pond with a grassed waterway leading into it. Vanderstappen plowed out that grassed waterway for crops.

'Then a big rain came," Vanderstappen says. 'It took out all that plowed ground and put it in the pond."

That anecdote is one Vanderstappen is not hesitant to tell as he explains the need for conservation practices on the land.

He now can give it a happy ending. This year, he drained the pond to remove the sediment. The pond will be refilled—but this time, not with soil. Vanderstappen has learned the value of grassed waterways.

Mr. Branigan is SCS district conservationist, Meadville, Pennsylvania.

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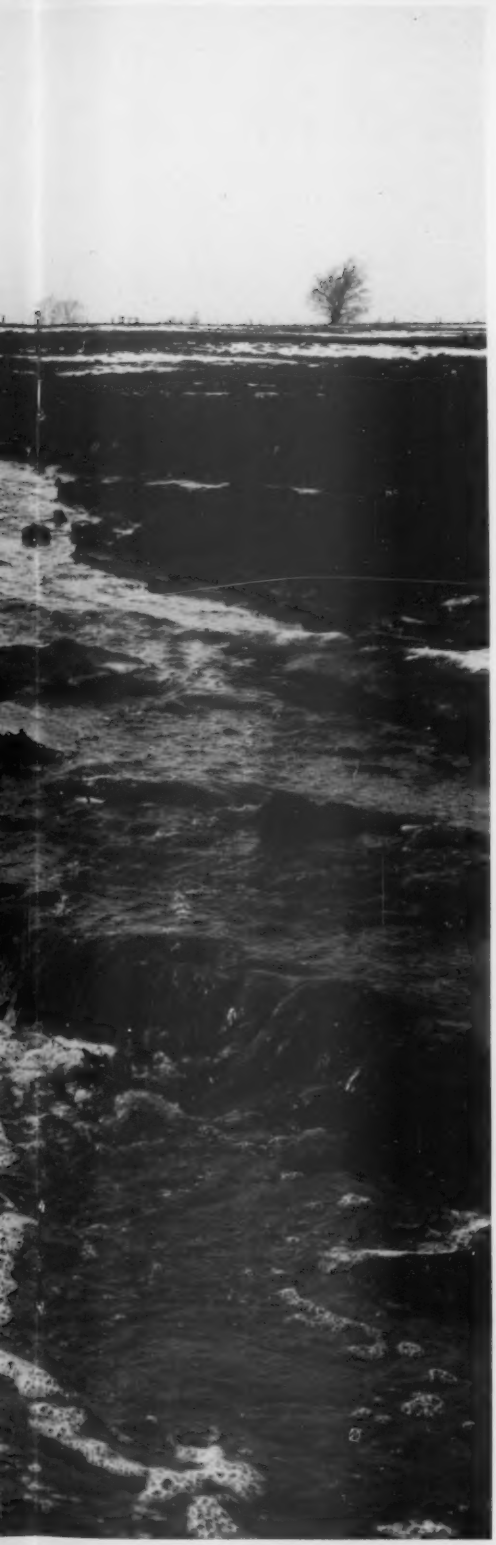


The following is a condensation of remarks by Glen E. Murray, State Conservationist, Kentucky, at the annual SCS State Conservationists Meeting, Kansas City, Missouri, in September 1976. Coauthor of the paper is Gerry R. Lowry, Environmental Services Division, SCS, Washington, D.C.

SCS and Water Quality: An Overview

Despite the long involvement of SCS in river basin, watershed, and other water-related activities, our agency's primary orientation is toward land conservation and development. Our interest in water quality has been stimulated by P.L. 92-500, the Federal Water Pollution Control Act Amendments of 1972. We now have national goals for clean water. Nonpoint sources of water pollution increasingly will be targets for corrective action. In light of the inseparable land and water aspects of a program to control nonpoint pollution, SCS has no choice but to become involved.

Nonpoint source pollutants include many things, but eroded soil and materials carried with the soil are primary targets. A disturbing projection, made by the Environmental Protection Agency's Mark Pisano in a recent *Journal of Soil and Water Conservation* article, is that 90 percent of all suspended solids contributed to the nation's waterways will originate from nonpoint sources after the 1977 point source goals are achieved. He also states that 79 percent of the nitrogen, 53 percent of the phosphorus, and 98 percent of the coliform bacteria will originate from nonpoint sources.

Water Quality

Water quality is the physical, chemical, and biological condition of water in relation to its beneficial use. Good water quality is a condition to permit or facilitate a desired land or water use. For example, water quality can be good for fishing but bad for drinking. Waste assimilation and transport also are legitimate uses for water, along with such other uses as fish production, navigation, irrigation, and esthetic enjoyment.

From a rural land user's viewpoint, the factors that contribute most to upstream water quality problems are:

1. Sediment from eroding lands;

2. Dissolved nutrients from erosion, runoff, and leaching;

3. Exotic chemicals and heavy metals, dissolved or linked to sediment;

4. Dissolved salts from irrigated or leached lands; and

5. Pathogens and various oxygen-demanding substances from animal wastes.

Manure from midwestern feedlot pours into stream after 2-day spring rain and snowmelt. Solution is animal waste lagoon or prompt collection of manure and subsoil application in fields.

Silt bar in estuary at mouth of Washington's Palouse River is part of 1.3 million tons of silt deposited there annually from rolling croplands above river.

Not all "nonpoint source pollution" results from man's activities. Sediment from South Dakota's Badlands was getting into rivers long before man came along.

Death of a Lake. Excessive sedimentation of lakes and rivers is not a new concern of SCS and conservation districts. In 1926 (top), Lake Como near Hokah, Minnesota, attracted hundreds of visitors each summer. By 1936 (bottom), the once beautiful lake was silted in, but for a small run trickling through the center. By this time, "wagonloads of dead fish had been carted off." Cause of death: farmers clearing timber from steep upland slopes, then plowing up and down hill for crops. Three valleys contributed the silt.

Nonpoint Sources

Nonpoint sources are the areas of land from which these substances originate. Most nonpoint source loads occur in the form of eroded soil. Sediment is not the whole story, however. Nitrogen, certain other chemicals, and dissolved salts traveling directly in water also distinguish between natural background loads of sediment and culturally increased loads. Before this country was settled —even by Indians—significant quantities of what 20th century man calls "nonpoint pollutants" were entering rivers and lakes. Sources include the Great Lakes shoreline, the Grand Canyon and Badlands, and young, raw streambanks. Some of the confusion about water-quality goals is related to a failure to recognize this natural background load —which in most cases has not been very well identified or quantified.

"Culturally induced loadings" are the increased volume of pollutants caused by man's activity. Until a point is reached where this increased load jeopardizes a desired beneficial use, there is technically no pollution.

Nonpoint source pollutants are not easily defined and come from diffuse areas. About the only practical way to approach control of the problem is to place standards on use and care of source areas and land use activities. Thus, the land-oriented conservation approach of SCS and the districts has been and is a nonpoint source water-quality program.

New Formula

One way to relate land use to water quality would be to devise a universal water contribution formula to complement the universal soil loss equation. Such a formula could predict the contribution of soil, nutrients, and other potential pollutants to receiving surface waters. From such a position, it would then be an easy step to a philosophy of using each acre of land so that its yield of nonpoint pollutants is within acceptable limits. Eventually, under P.L. 92-500, "acceptable" is going to be determined through the establishment of best management practices on the

land. Again, our attention is directed back to the land.

We also need to clearly reflect water-quality needs when we discuss alternative combinations of practices. Using this same approach, we could develop the best combination of practices needed to meet water-quality standards in a particular watershed. This is really not that much different from what we have been doing; it is merely an expansion of our planning concept to account for the effect of land use and treatment on water.

Past Efforts

Excessive erosion and sediment have been central concerns of SCS and districts since our beginning. In 1938 it was noted that the bed of the Rio Grande River in central New Mexico had risen 5 feet in 9 years. The Arkansas River in western Kansas had risen 5 feet during the previous 45 years. Four reservoirs on the New River in Virginia had lost from 23 to 83 percent of their capacity due to sediment in periods varying from 6 to 33 years. Similar reports were common from every section of the country.

We all are familiar with past efforts to get at this problem. The search for the best way to get practices on the land produced the conservation district institutional framework.

In 1955 and 1964, respectively, the watershed and RC&D approaches to resolving conservation problems over wide areas were implemented.

Within watershed projects alone, land users are estimated to be reducing erosion by more than 50 million tons annually through conservation measures on their lands. About 24 million tons of sediment have been trapped in reservoirs to prevent further damage downstream. More than 900 critical area treatment measures have been planned by local governments through the RC&D program. Watershed projects, however, cover only 3 percent of the United States, and 50 million tons of sediment is only about 1 percent of the annual discharge of sediment to our nation's streams.

Current Picture

Today, the public is coming to recognize water pollution and to learn that sediment is a major consideration in all uses of water and is still the largest single pollutant by volume. About 4 billion tons

A well-protected watershed prevents sedimentation as well as soil erosion. Soil in Minnesota's West Willow Creek watershed is kept in place with contour stripcropping, terraces, diversions, and grassed waterways.

"Even during the 43 years of the Soil Conservation Service, Americans have not used the land as well as they know how . . ."

of sediment reach our streams each year. The U.S. Geological Survey estimates that nearly one-half billion tons are discharged to the oceans annually, while another estimate is that 1.3 billion tons are trapped in reservoirs. Despite many efforts to study sediment, there has been no overall evaluation of its social and environmental cost.

Around 30 percent of today's sediment is natural background from geologic erosion. About 50 percent of sediment comes from agricultural land. Another 10 percent comes from range and forest lands, and the remaining 10 percent from eroding roadsides, construction activities, surface-mined lands, and other disturbed areas. About 70 percent of the total, theoretically, is subject to control at its source through soil and water conservation efforts. Our water-quality goals under P.L. 92-500 can never be met without a program to control a substantial portion of this sediment. This should then answer the question of whether a rural upstream water-quality program is needed.

We must recognize that to become actively involved in controlling sediment is a massive undertaking and job. No program or regulation can reach every acre. Even under the best land use and conservation systems, we know some soil will be lost. The key lies in reaching those acres where erosion is most critical. Conservation programs are needed on selected lands, to control selected erosion-causing activities.

Key Factors

The best conservation program in the world is no good if it remains on paper and is not put on the ground. Even during the 43 years of the Soil Conservation Service, Americans have not used the land as well as they know how; the same will probably be true with water-quality practices. If we are going to encourage others to participate in water-quality planning and application, the incentive system may well be a key factor for long-term success.

Voluntarism has been the leading edge of the system of incentives causing people to practice proper land use. This system has enjoyed remarkable success through conservation districts.

Economic incentives, or "the carrot," have been reasonably successful in the form of programs like ACP and REAP in stimulating practice application. The carrot has been a dismal failure, however, in lesser developed countries. Even in the United States, economic incentives will never be more than part of the picture due to the anticipated steep rise in the cost of achieving nonpoint source control.

The third primary incentive for proper land use in this country is law or regulation. Use of this device appears to be growing rapidly, particularly at the state level. Faced with a need to get a handle on air, water, and land pollution control within a short time, it is only natural that states have turned to regulation. Direct regulation, such as 404 permit systems, Iowa erosion control programs, and New York and Pennsylvania's permit and planning requirements, appears to be the "nonpoint wave of the future." Fifteen states have erosion and sediment control legislation.

In relation to water quality, the question is, "What combination of incentives is best to get the job done and still preserve as much freedom of choice as possible?" I believe SCS should take a strong position—advocating a mix of incentives containing about 10 parts voluntarism, five parts economic, and one part legal. The strong voluntarism approach is the conservation district program—the message here is stay with districts. This is still the soundest and most democratic long-term solution to land and water-quality problems.

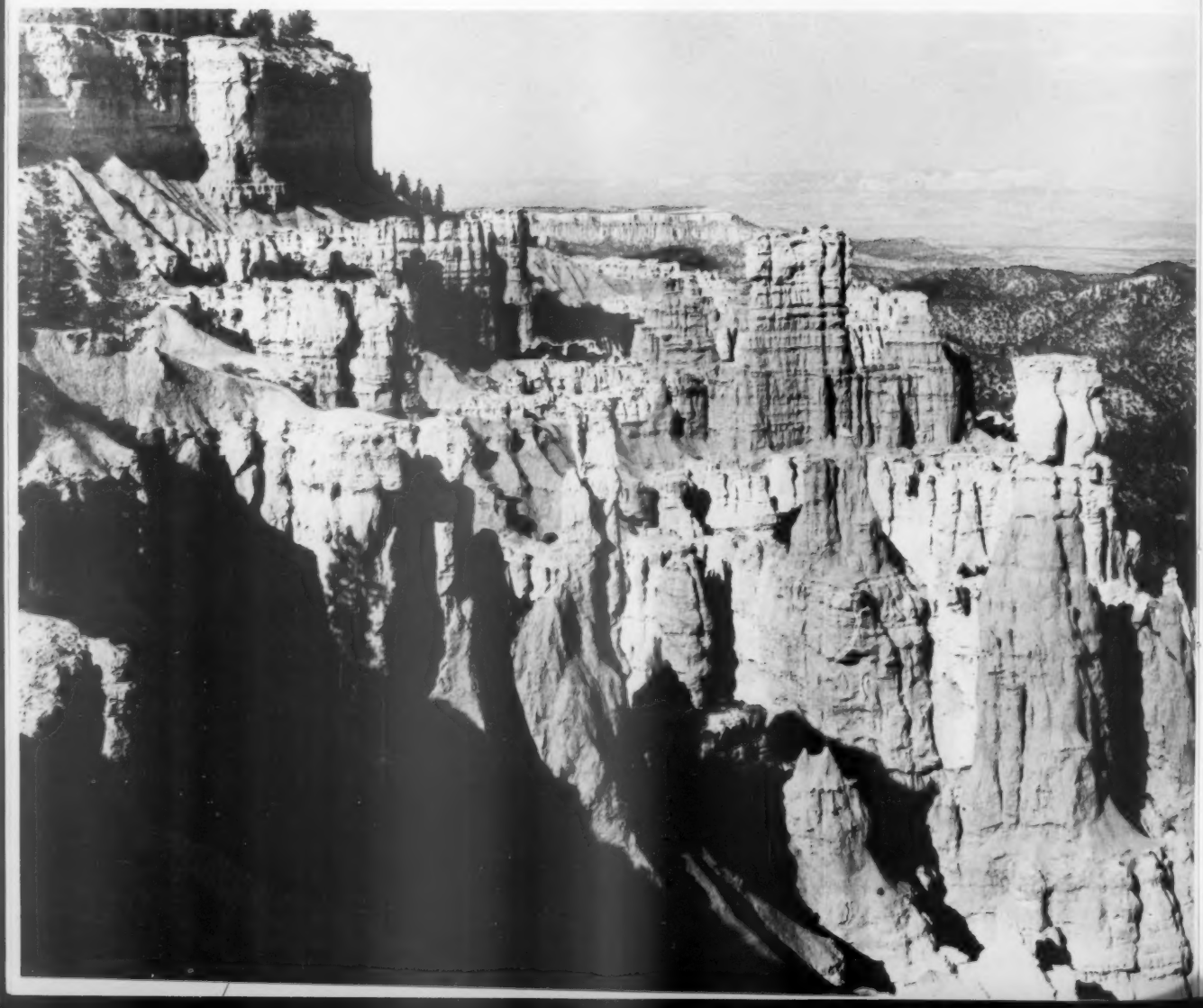
Summary

- There is a persistent and important water-quality problem in rural America.
- SCS and conservation districts are uniquely well suited to lead the attack on these water-quality problems. We have key roles—even if they are different.
- The conservation plan provides a basic mechanism for attacking the nonpoint problem.
- We have a strong history in land use and management and this is precisely where water-quality problems originate. We need to expand conceptually and technically to account for water-quality effects. Some further changes are needed in organization, in the mix of our expertise, in technical methods, and in programs. We need to do this carefully and with a great deal of thought.
- Getting the proper mix of incentives is a key problem in water quality.
- Regulations will likely be a more widely used incentive.

Erosion and Sediment in the West

by John D. Hedlund

In a study in the 11 western states, SCS looks into the amount of erosion and sediment occurring and what might be done about it.



What's the status of erosion in the West today . . . and what can be done about it?

That's the subject of a study by the Soil Conservation Service which has resulted in a 152-page report on "Erosion, Sediment, and Related Salt Problems and Treatment Opportunities."

Nearly 100 million acres—or 15 percent of the land in the 11 western states—have an average annual sediment yield greater than 0.5 acre-feet* per square mile, the rate at which serious erosion was assumed for this study.

Most of the severely eroding land is in five states—Arizona, California, Montana, New Mexico, and Utah. California alone has 21 million acres that are severely eroding.

The most extensively eroded cropland in the western states is the 8.4-million-acre wheatland area of the Columbia Plateau in Washington, Oregon, and Idaho. This area, which includes the Palouse, has erosion rates that range up to 100 tons of soil loss per acre per year. In the Palouse, all the topsoil has been eroded from 10 percent of the land and 25 percent to 75 percent of the topsoil has been eroded from an additional 60 percent of the land.

The highest sediment yields per square mile of any river system in the United States are in northwestern California. This is due primarily to erosion from channels and landslides and from poor logging practices.

Total sediment yield in the West is estimated at 660 million tons each year. It accumulates in reservoirs and streams, increases flooding, decreases the capacity of irrigation and drainage systems, destroys crops, decreases the recreational value of water, and adversely affects fishery resources.

Erosion is also a major contributor to the 90 to 100 million tons of salt going into western surface waters each year.

Much of the sediment in western streams is the result of geologic and streambank erosion for which there are few economically feasible conservation solutions. On some watersheds, more than 50 percent of the sediment is from gully, channel, and streambank erosion.

The study, based on field reports from SCS offices in the 11 western states, indicates sediment yield could be reduced by an average of 15 percent if treatment measures to control erosion were installed on 394 million acres and 107,000 miles of stream channels in the West. In some states, as much as 43 percent of the sediment could be prevented. The estimated average annual cost of such a program is in 1970 dollars $531 million a year.

The measures include land treatment and management, such as rangeland seeding and brush control, and land use changes on 6 million acres, including switching from row crops to a permanent cover crop in some areas and taking some fragile rangeland out of grazing use.

These erosion control improvements would also result in a salt load reduction of more than 2 million tons per year. In addition, improved irrigation methods to decrease salt accumulations in return flows are needed.

In a breakdown by state, the SCS report shows:

Arizona

Of its 73 million acres, Arizona has 390,000 acres with severe erosion problems. Much of the erosion occurs in the upper watersheds and then affects irrigation downstream. Water diverted from the Gila River, for instance, is heavily laden with sediment from the San Pedro River. The deposition of these sediments decreases the capacity of canals, ditches, and reservoirs and decreases the rate of water intake into irrigated soils. Another problem is the sharp increase in salt concentration occurring on the Colorado River at the Mexican border. The Wellton-Mohawk Drainage Canal discharges 1 million tons of salt annually into the Colorado River system in irrigation return flows. An interagency program, in which SCS is participating, is underway to minimize the effects of salt loading. Improved onfarm irrigation management is needed to reduce salt loading and should be carried out in conjunction with an erosion control program.

California

About 80 percent of the high sediment yield areas in the state are on streams draining the north-, central-, and south-coastal areas. The Eel and Mad River watersheds are sources of high sediment yields: the Eel River has the highest reported average annual sediment yield per square mile of any stream of comparable size in the United States. Channel erosion, landslides, and poor logging practices are the primary sources of sediment. In many areas only 10 to 15 percent of the sediment comes from sheet and rill erosion on the watershed. About 20 percent of the streambanks in the state have moderate to serious channel erosion. The San Joaquin watershed of 13,540 square miles has an average annual salt load of 412 tons per square mile, which is the highest recorded for a large watershed in the United States. A treatment program on 3 million acres to reduce soil salts and to improve irrigation practices and on 8,200 bank miles of channel to control erosion in the state could reduce annual sediment yield 5 percent and salt load 1.5 million tons.

Colorado

Serious erosion, sediment, and salt-loading problems exist in the semiarid shale badlands or shale-derived alluvium in western Colorado and in the Arkansas Valley of

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* Conversions between acre-feet and tons can only be made when an average dry weight of the soil is known or assumed. Then, to get the tons per acre-foot, the conversion factor is 21.78 multiplied by the pounds per cubic foot. For example, if an upland soil has an average dry weight of 85 pounds per cubic foot, then 1 acre-foot weighs 1,851 tons. On the other hand, an acre-foot of sediment that weighs 60 pounds per cubic foot (dry) in a reservoir would be equivalent to 1,307 tons.

With no streambank protection, this wash on a farm in Arizona carries floodwater and sediment to the Gila River.

Improved onfarm irrigation management is needed to reduce salt loading and erosion damage.

A gulley, caused by uncontrolled irrigation water, continues to carve a path through deep loess soil in Wyoming.

Much of the sediment in western streams is the result of geologic and streambank erosion for which there are few economically feasible conservation solutions.

eastern Colorado. Serious erosion and the resulting high sediment and salt yields pollute waters of the mainstem of the Colorado, Gunnison, Dolores, and San Juan Rivers in western Colorado. In eastern Colorado serious erosion occurs mostly in alluvial valleys along the foothills in Las Animas, Huerfano, and Pueblo Counties where it has been accelerated by such past activities as coal mining and overgrazing. Treatment needed to reduce sediment and salt includes changes in land use on 24 million acres, improved management on 12 million acres, land treatment and management on 9 million acres, and 3,300 miles of channel improvement. If these practices are installed they could reduce sediment yield 21 percent and reduce salt loading associated with erosion by 90,000 tons annually.

Idaho

Serious land and water quality problems exist in Idaho because of channel and sheet erosion on 600,000 acres which have an annual erosion rate over 10 tons per acre. This erosion rate is too high to protect the productivity of the land. The largest areas of soil loss occur in the deep loess soils of the Palouse area, the areas near the Snake River plain, and on the Bear River watershed in southeastern Idaho. Some of the most severe erosion occurs in the watersheds of Rock, Hangman, and Cow Creeks and the Coeur d'Alene, Palouse, Potlatch, and Clearwater Rivers. Streambank erosion has caused land and property damages on the Raft, Teton, Big Lost, and Salmon Rivers and in some areas of Kootenai, Benewah, Latah, Nez Perce, Lewis, Idaho, and Shoshone Counties. SCS has made a recent study of impacts due to erosion and sediment control measures in Idaho. A substantial reduction in sediment delivered to the streams is possible. Practices, programs, and technical expertise are available to accomplish this reduction if they are applied.

Montana

Severe erosion, sediment, and salt problems are localized and occur mostly in eastern and central Montana. Geologic erosion of barren or nearly barren outcrop areas of Pierre and Bearpaw Marine Shale Formations produces large amounts of sediment and salt. Nearly 10,000 square miles have extensive areas of salt-affected soils which also contribute to salt loading of streams in eastern Montana. Opportunities to reduce erosion, sediment, and salt loading in Montana include changes in land use to provide increased ground cover on nearly a million acres, improved management on 15 million acres, land treatment and management on 37 million acres, and channel improvement on 6,000 miles. The average annual cost of the treatment program is estimated at $62 million and would result in a 33 percent reduction in annual sediment yield.

Nevada

Statewide, Nevada sediment yield is the lowest in the West, due to its arid climate. Serious erosion, sediment, and salt loading problems exist in the Muddy, Virgin, and Meadow Valley Wash watersheds, which are tributaries to the Lower Colorado River. Severe channel erosion occurs along tributaries of the Lower Colorado River, the Truckee River where it discharges into Pyramid Lake, and on several tributaries of the Humboldt River. Because of the state's arid and semi-arid environment the primary treatment program to reduce erosion and enhance water quality has been identified as improved land management on 53 million acres.

New Mexico

New Mexico finds itself in the undesirable position of having the highest average annual sediment yield rate of any state in the West. Serious erosion and related sediment and salt problems exist over most of the state. High salt loading of streams from nonpoint sources correlates with the higher sediment yield areas. About 11,000 square miles have saline soils, and about 12,000 square miles have high annual sediment yields. Of the 112,700 miles of stream channel in the state, 40,000 miles have serious or moderate streambank erosion. In many watersheds, 70 to 90 percent of sediment yield is from gully and channel erosion while only 10 to 30 percent is from sheet and rill erosion. The Pecos River, the Rio Grande, and their tributaries carry a high sediment and salt load in their runoff. This significantly increases the cost of water use and reduces its utility.

Oregon

Critical erosion and sediment loading problems exist in south coastal areas, particularly in areas of heavy timber cut on unstable soils. On the Sixes River watershed in southwest Oregon, where at least 80 percent of the watershed has been harvested over a period of years, sediment yield rates average 2 acre-feet per square mile. The soils in the area are generally unstable, and as many as 25 landslides per quarter mile have been observed along road cuts. High sediment yields also occur on the loess soils in the Umatilla watershed and the granitic soils along the Wallowa Mountains which have little or no vegetative cover. Serious and moderate channel erosion occurs on nearly 14,000 miles of streams in the state and is frequently accompanied by local landslides and overflow. Through changes in land use, improved management, land treatment, and channel stabilization and protection, sediment yield could be reduced by 43 percent.

Utah

Channel, gully, and sheet erosion of the numerous gypsiferous deposits,

Total sediment yield in the West is estimated at 660 million tons each year, accumulating to increase flooding and decrease productivity of the land.

marine shales, and halite outcrops have a major effect on the quality of runoff water in the state. Bryce Canyon, Cedar Breaks, Zion, Capital Reef, Arches, and Rainbow Bridge are national parks or monuments which have high erosion rates; however, this is geologic erosion and adds to the scenic beauty of the area. Land treatment measures and management are not generally economically feasible in areas with high geologic erosion; therefore, most of Utah's sediment and salt reduction will occur on areas of moderate erosion and salt yield. In some reservoirs, annual sediment deposition displaces enough water to irrigate a 250-acre farm. SCS estimates that sediment yield could be reduced 13 percent and annual salt loading could be reduced 300,000 tons if a treatment program including change in land use on 1 million acres, improved management on 25 million acres, management coupled with structural and land measures on 6 million acres, and channel improvement on 33,000 streambank miles were implemented.

Washington

Severe erosion and sediment source areas in the Columbia Plateau exist on 5.7 million acres of nonirrigated grainlands in 13 counties. About 2.1 million acres of dry cropland have average annual sheet and rill erosion rates of 6 to 12 tons per acre, and 760,000 acres of irrigated cropland have annual erosion rates of 6 to 12 tons per acre. Soil losses through erosion on dry cropland during some years can be 25 to 150 tons per acre in the Palouse. Sediment deposition results in increased flooding, accumulation in reservoirs, damage to irrigated lands, a decrease in the recreational value of water, and adverse effects to the fishery resources of the Columbia River. A reduction in sediment yield of 75 percent is possible in critically eroding areas with land treatment, supplemental structures, and conversion of steeper slopes to grassland. Change in land use is difficult to achieve when demand for food production is high and economic return from wheat is well in excess of production costs.

Wyoming

Severe erosion, sediment, and salt loading problems exist in the semiarid basins where saline soils are found. These soils erode readily, and in the process salts are dissolved and carried with the sediment into the streams. Degradation of water quality exists in large watersheds, including Powder, Wind-Bighorn, North Platte, and Green River Basins. Gully erosion accounts for more than 50 percent of sediment yield in these basins. Sediment loading can be reduced 22 percent if a treatment program is implemented including improved management on 47 million acres, mechanical land treatment on 9 million acres, and channel stabilization on 10,000 streambank miles.

Mr. Hedlund, formerly SCS hydraulic engineer, Special Projects Division, Golden, Colorado, is SCS soil conservationist, West Technical Service Center, Portland, Oregon.

Helping Hands

by Charles R. Adams

On a 6-acre plot at the Abilene State School in Texas, mentally retarded students are harvesting seeds by hand to produce benefits for wildlife and livestock around the state. At the same time, they are receiving the benefits of therapy and horticultural training.

The project got underway last spring as a cooperative venture by the Middle Clear Fork Soil and Water Conservation District, the Soil Conservation Service, and the school, one of several Texas centers for the training, development, and rehabilitation of the mentally handicapped.

The SCS plant materials center at Knox City, Texas, provides forbs and shrubs for which mechanical harvesting is not possible. Most of the plants were once abundant in Texas but have been nearly wiped out by overgrazing. The plant materials center is using the new seed stock for test trials to reestablish the plants on native range.

Shrubs grown at the center include littleleaf leadtree, smallflower peachbush, and Wright's anisacanth, all used for livestock grazing and wildlife browsing. The students also harvest seed from such forbs as skeletonleaf goldeneye, englemann daisy, prostrate bundleflower, and least snoutbean.

SCS provides technical assistance for planting, cultivating, irrigating, and harvesting. The agency earlier prepared an inventory and evaluation of soil and water resources at the school and designed a drip irrigation system for the plot.

The school, the conservation district, and SCS will review results of the project each year to see that it continues to provide training and therapy for the students and native plant seedlings for Texas rangelands.

Mr. Adams, formerly SCS soil conservationist in Abilene, is SCS district conservationist, Eastland, Texas.

Meetings:

November

18–22 Adult Education Association of the U.S.A., New York, N.Y.

24–27 National Council for Geographic Education, San Francisco, Calif.

28–30 American Society of Farm Managers and Rural Appraisers, St. Louis, Mo.

28–Dec. 1 World Wildlife Fund Fourth International Congress, San Francisco, Calif.

28–Dec. 2 American Institute of Chemical Engineers, Chicago, Ill.

28–Dec. 3 American Society of Agronomy, Crops Science Society of America, and Soil Science Society of America Joint Annual Meeting, Houston, Tex.

30–Dec. 3 Western Forestry Conference, Portland, Oreg.

December

1 Annual Meeting and Awards Banquet, Keep America Beautiful, Inc. New York, N.Y.

2–3 National Association of Manufacturers, New York, N.Y.

6–10 American Geophysical Union, San Francisco, Calif.

7–9 American Seed Trade Association, Inc., Sorghum Research Conference, Chicago, Ill.

8–9 American Forest Institute, San Francisco, Calif.

9–10 American Seed Trade Association, Inc., Soybean Research Conference, Chicago, Ill.

10–17 International Symposium on Land Subsidence, Sponsored by International Association of Hydrological Sciences, Anaheim, Calif.

13 "Drainage for Increased Crop Production and a Quality Environment," Sponsored by American Society of Agronomy, Crops Science Society of America, and Soil Science Society of America, Chicago, Ill.

January

9–12 American Farm Bureau Federation, Honolulu, Hawaii

9–13 National Council of Farmer Cooperatives 48th Annual Meeting, San Juan, Puerto Rico

10–14 North American Game Breeders and Shooting Preserve Association National Convention, Milwaukee, Wisc.

16–19 National Wool Growers Association—National Lamb Feeders Association Convention, Monterey, Calif.

30–25 American National Cattlemen's Association Annual Convention & Trade Show, Atlanta, Ga.

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